

*Weinschel Engineering*

KENSINGTON, MARYLAND



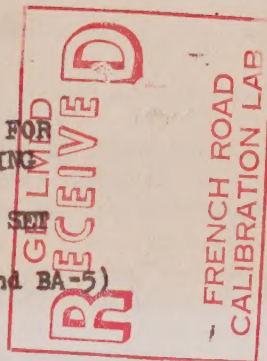
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OPERATING INSTRUCTIONS FOR  
WEINSCHTEL ENGINEERING  
DUAL CHANNEL  
INSERTION LOSS TEST SET  
Incorporating  
(Models BA-1, ND-1, and BA-5)





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## WEINSCHEL ENGINEERING

### DUAL CHANNEL INSERTION LOSS TEST SET

#### Introduction

The Dual Channel Insertion Loss Test Set employs the audio substitution principle. In a system of this type, the attenuation measurement is made by substituting attenuation in the AUDIO PORTION of the measurement channel for the RF ATTENUATION of the unit under test. Because the audio voltage developed across the barretter is proportional to the rf power, the substituted audio attenuation is twice the rf attenuation in decibels. Since the BA-5 has been designed for this application, it is calibrated in terms of the rf insertion loss. Even though the audio attenuator in the BA-5 covers a range of 52 db (rf), only a 20 db (rf) range can be used within the accuracy specification given for this system. This limitation is due to 1000 cycle leakage signals introduced through ground currents departure from square law of the detector characteristic at large signal levels as well as noise at low signal levels.

The instructions contained in this manual provide a step-by-step procedure for the proper operation and measurement procedure to be used when operating the Dual Channel System.

Charts are provided in the back of the manual for proper selection of components necessary for operating the system in the various frequency ranges from 50 mc to 90 kmc. Easy to follow block diagrams are included to help in setting up and adjusting the system.

For the theory of operation and maintenance of the various electronic units, refer to the individual manuals provided with the particular equipment. If trouble is encountered in the system, a quick preliminary troubleshooting guide is provided. (Page 11)



## SYSTEM REQUIREMENTS

To obtain accurate measurements using the Dual Channel System, care should be taken to be sure that the following requirements are met:

1. RF Source must be 100% square wave modulated. Refer to section V for proper procedure in checking the modulation.
2. The modulation frequency should be within .1 cps of 1000 cps. If RF Sources other than the Weinschel Models MS-8 to MS-11 are used, it is recommended that the Weinschel Model MO-1 be incorporated into the system.
3. Be sure that there is no 1,000 cps ground loop present in the system between the modulator and the output of the BA-5.
4. The line voltage must be stable; if not, a voltage regulator is recommended for use with the BA-1 and BA-5.
5. Care should be taken in establishing the proper RF power level at the measurement bolometer.

### IMPORTANT

STUDY THE INSTRUCTIONS AND BLOCK DIAGRAMS THOROUGHLY  
BEFORE SETTING UP THE DUAL CHANNEL SYSTEM.

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## SECTION I

### PRELIMINARY SET UP

- 1.1 Without primary power connected to the units, set up dual channel system as shown in Figure 1 or Figure 3 (A or B) depending on whether the system is to be waveguide or coaxial. Refer to step 1.4 (A) or (B) for proper level adjusting attenuators.
- 1.2 Be sure all RF connections are secure: connect the BA-1, BA-5, and ND-1 in the following manner, using RG-58 cables.  
  
Connect: Output of reference bolometer to input of BA-1.  
Output of BA-1 to input #1 of ND-1 (Reference input).  
Output of measurement bolometer to input of BA-5 (Length of connection between the BA-5 and bolometer mount must not exceed 36 inches).  
Output of BA-5 to input #2 of ND-1 (Measurement input).
- 1.3 Set controls on the BA-1 and BA-5 to the following positions:  
  
(A) BA-1--BOLOMETER CURRENT ADJUST - Full counterclockwise  
Output Control (COARSE and FINE) - Full counterclockwise  
ON-OFF Switch to "OFF" position  
  
(B) BA-5--BOLOMETER CURRENT ADJUST - Full counterclockwise  
GAIN (COARSE and FINE) - Full counterclockwise  
All Attenuators to Zero  
ON-OFF Switch to "OFF" position
- 1.4 Make the following adjustments in RF section:  
  
(A) Waveguide System (Figure 1) -- Adjust level set attenuators 1 and 2 to maximum attenuation. If the RF source provides more than 20 mw of RF power and does not have an internal level set attenuator, be sure to insert enough additional attenuation between the RF source and level set attenuator #1 so that the peak power into bolometer mount #1 does not exceed 200 microwatts with at least 20 db of attenuation inserted in level set attenuator #1.  
  
(B) Coaxial System (Figure 3A & B) -- Be sure that the correct amount of attenuation is inserted between the RF source and the directional coupler so that the output of the main arm of the directional coupler is set to 20 mw peak power.
- 1.5 After above precautions have been taken, apply primary power to all units and turn all "ON-OFF" switches to the "ON" position.
- 1.6 Adjust RF source to desired frequency.
- 1.7 Adjust proper bias power (4.5 ma or 8.75 ma) to bolometers, as indicated on the BA-1 and BA-5 bolometer current meters.

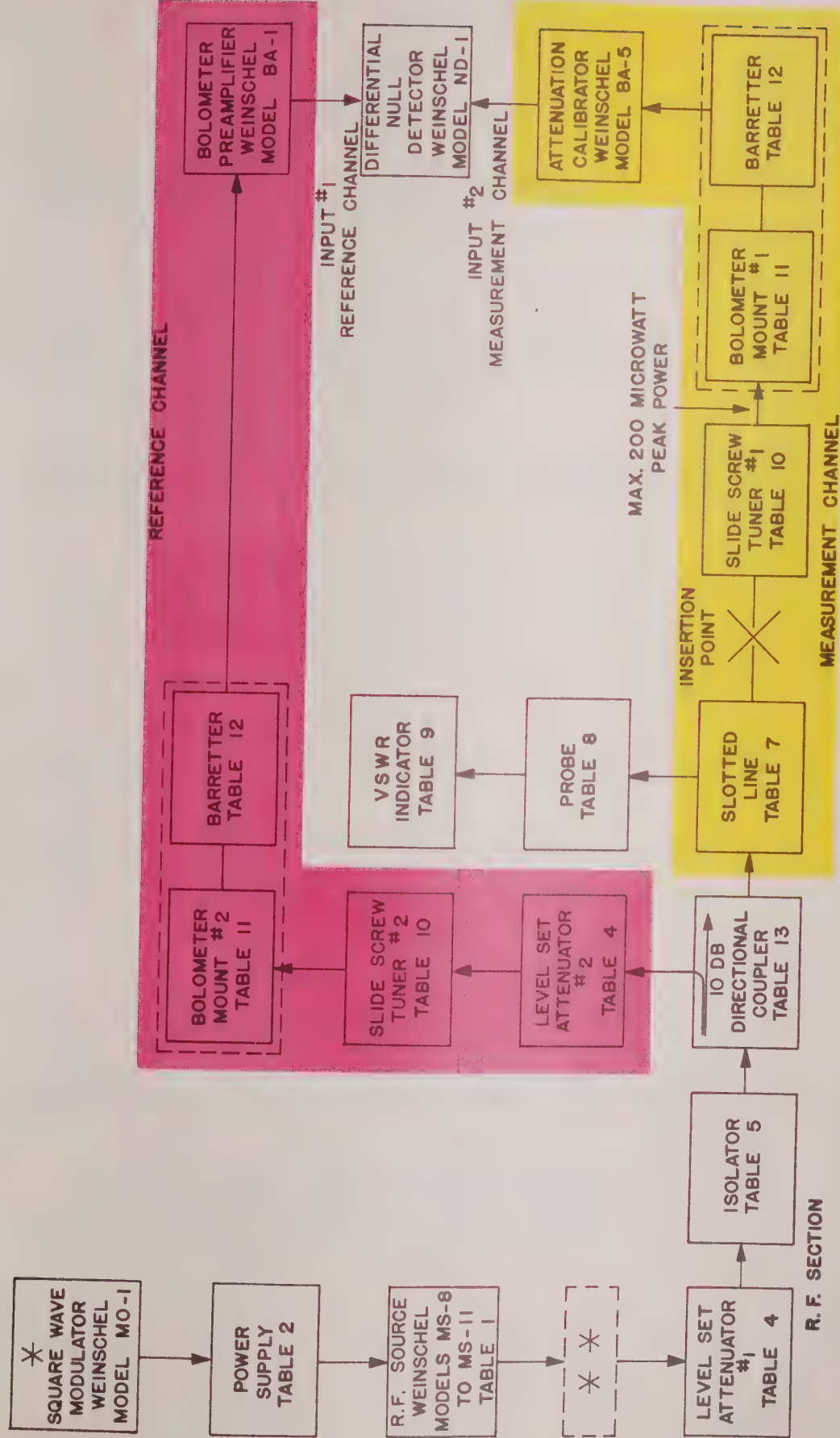


- 1.8 Allow equipment to warm up for a period of one hour.
- 1.9 Recheck frequency of RF source.

#### TUNING AND ADJUSTING THE RF SECTION

In order to make accurate insertion loss measurements, it is important that the source and load impedance of the RF section is matched to the characteristic impedance of the transmission line and that the proper power level at the bolometers be established. After the equipment has warmed up for the prescribed period of time, continue following the steps outlined in Section II or Section III depending on whether the system is waveguide or coaxial.





\* NOT REQUIRED IF WEINSCHTEL MODEL MO-3 IS USED WITH MODELS MS-8 TO MS-11.

\*\* INSERT FREQUENCY MONITORING SECTION HERE, IF DESIRED. SEE FIGURE 6.

FIGURE 1, BLOCK DIAGRAM  
DUAL CHANNEL INSERTION LOSS TEST SET UP, WAVEGUIDE SYSTEM.



SECTION II  
WAVEGUIDE SYSTEMS

2. IMPEDANCE ADJUSTMENT OF THE MEASUREMENT CHANNEL

- 2.1 Connect the RF line together at the insertion point. (Figure 1)
- 2.2 Adjust level set attenuator #1 until an indication is seen on the BA-5 meter (approximately 1/2 scale).
- 2.3 Adjust tuner #1 for maximum indication on the BA-5 meter. (NOTE: Increase attenuation at level set attenuator #1 to prevent meter from exceeding full scale deflection.)
- 2.4 If tunable bolometer mount is used, adjust tuner on the mount for maximum indication on BA-5 meter. (NOTE: Increase attenuation at level set attenuator #1 to prevent meter from exceeding full scale deflection.)
- 2.5 Insert and tune RF PROBE at the slotted line for maximum indication on the standing wave indicator. (NOTE: When using the H-P 415B Standing Wave Indicator, the attenuator on the 415B should be at the 40 db or 50 db position, adjust output level of RF Source if necessary.)
- 2.6 Measure the VSWR of the load (tuner #1 and bolometer mount #1).
- 2.7 Adjust tuner #1 for an indicated VSWR of less than 1.01:1. When a tunable bolometer mount is used, a fine adjustment of the mount can now be made.

3. IMPEDANCE ADJUSTMENT OF THE REFERENCE CHANNEL

- 3.1 Set up equipment as shown in Figure 2.

CAUTION

DO NOT CHANGE SETTING OF ATTENUATOR #1

- 3.2 Measure the VSWR of the reference bolometer.
- 3.3 Adjust tuner #2 for an indicated VSWR of 1.01:1 when tunable bolometer mount is used or fine adjustment of the mount can be made.

After completion of above procedure, set up equipment again as shown in Figure 1, Complete connection at insertion point but remove slotted line.



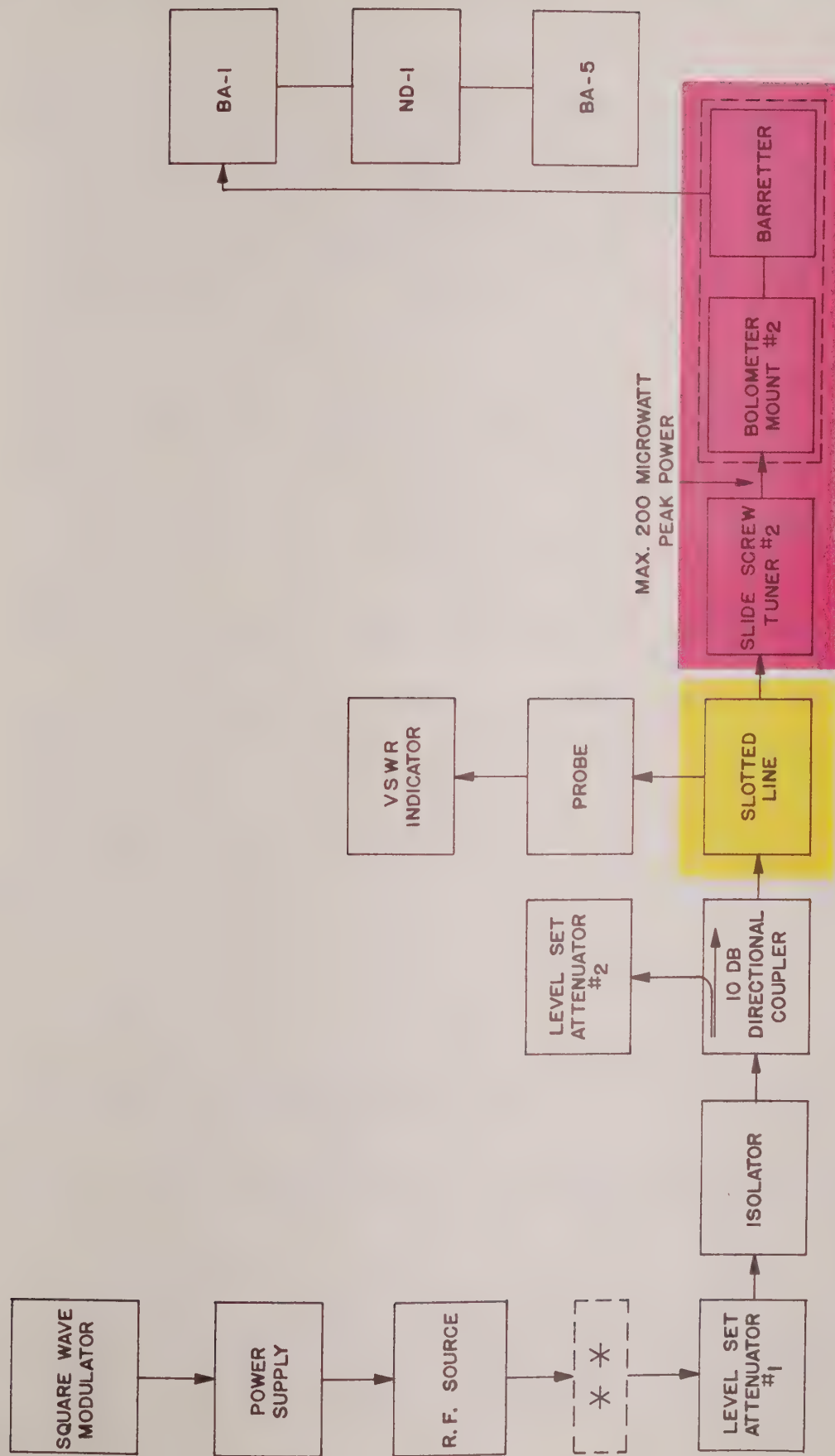


FIGURE 2, BLOCK DIAGRAM  
SET UP FOR TUNING REFERENCE BOLOMETER, WAVEGUIDE SYSTEM.



4. ADJUSTMENT OF PROPER RF POWER LEVEL AT THE MEASUREMENT BARRETTTER

- 4.1 With the COARSE and FINE gain controls on the BA-5 counterclockwise and all BA-5 attenuators set to ZERO, adjust level set attenuator #1 for full scale deflection on the BA-5 meter. This places the proper amount of rf power, approximately 200 microwatts peak, at the barretter, to insure that it is operating within its square law region. There should be at least 20 db of attenuation available at level set attenuator #1 when finished.

5. ADJUSTING THE SYSTEM FOR A NULL

- 5.1 Insert a sufficient amount of audio attenuation at the BA-5 to cover the expected insertion loss measurement. Example: BA-5 to read 12.05 db for 10 db R.F. measurement; BA-5 to read 22.05 db for 20 db R.F. measurement.
- 5.2 Adjust gain of BA-5 until meter reads approximately 7 db on the scale.
- 5.3 Set gain controls on BA-1 to mid-range.
- 5.4 Disconnect both inputs to the ND-1 and adjust "ZERO CONTROL" on front of the panel until meter reads "ZERO".
- 5.5 Set attenuator #2 to ZERO and adjust the gain of the BA-1 and the phase controls of the ND-1 until a null is approached.
- 5.6 For final adjustment of the null, use the FINE gain controls of the BA-1, BA-5, and the phase controls of the ND-1.

6. MEASUREMENT PROCEDURE FOR FIXED ATTENUATORS, 0 - 20 DB

- 6.1 Record attenuator settings on BA-5.
- 6.2 Disconnect RF line at insertion point in Figure 1.
- 6.3 Insert unit to be measured.
- 6.4 Reduce attenuation in BA-5 until null is again approached.
- 6.5 With MEDIUM and FINE phase controls on the ND-1 and the 0 to .1 db attenuator on the BA-5, adjust for final null.
- 6.6 Record reading of BA-5 attenuators. The difference between the initial setting of the attenuators and the final setting is the insertion loss of the device under test.

7. EXTENDING THE RANGE

Although the dynamic range of the dual channel system is 20 db (rf), a 40 db measurement can be made accurately by employing partial rf substitution. One requirement for this would be, e.g., the calibration of a continuously variable attenuator such as the Hewlett-Packard Rotary Vane type.

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To make a measurement of this type, set up the equipment and adjust the system as previously described in Paragraph 1 through 5.

8. MEASUREMENT PROCEDURE FOR CONTINUOUSLY VARIABLE ATTENUATORS, 0 - 40 DB

NOTE: After initial null is established, (Par. 5) without the unit under test in the system, a "ZERO INSERTION LOSS" measurement must be made on the unit. This is accomplished in Steps 8.1 through 8.4:

- 8.1 Record attenuator setting at BA-5. This should be 12.05 db.
- 8.2 Set variable attenuator under test to "ZERO" and insert unit at insertion point (Figure 1).
- 8.3 Adjust BA-5 attenuators and PHASE controls on ND-1 until ND-1 reads a null.
- 8.4 The difference between readings of BA-5 attenuators, before and after inserting the unit, is the "ZERO INSERTION LOSS" of the unit.
- 8.5 After above measurement is made (do not remove unit under test) and before proceeding to calibrate the "incremental insertion loss" of the unit under test, be sure there is sufficient attenuation in the BA-5 to cover the first 20 db to be measured (22.05 db). Recheck for null on ND-1.
- 8.6 Adjust variable attenuator under test to first point to be measured, such as the 1 db position.
- 8.7 Reduce BA-5 attenuator until null is again read on ND-1. (Use phase adjustment if necessary). Repeat this procedure for each point to be calibrated up to 20 db.
- 8.8 Important: Leave variable attenuator under test at LAST CALIBRATED POINT (20 db) and insert 20 db of attenuation at the BA-5.
- 8.9 Adjust level set attenuator #2 to approximately 20 db, reduce attenuation of level set attenuator #1 and adjust the phase shift controls on the ND-1 until the ND-1 returns to null. For fine adjustment of the null, use the 0 to .1 db attenuator on the BA-5.

The unit under test can now be calibrated an additional 20 db; follow Steps 8.6 and 8.7.

CAUTION

AT COMPLETION OF CALIBRATION, SET ATTENUATION OF ATTENUATOR #1 TO MAXIMUM, THIS WILL INSURE RF BURN OUT PROTECTION FOR THE BARRETTTER.



### SECTION III

#### COAXIAL SYSTEMS

The next portion of this manual covers insertion loss measurements up to 20 db using a coaxial dual channel system. Follow preliminary set up procedures as outlined in Section I and the block diagram in Figure 3A.

#### 9. IMPEDANCE ADJUSTMENT OF THE MEASUREMENT CHANNEL

NOTE: With 20 mw peak power present at the output of the main arm of the directional coupler and 20 db of attenuation at attenuator #2, the BA-5 meter should be approximately full scale when the line is properly tuned.

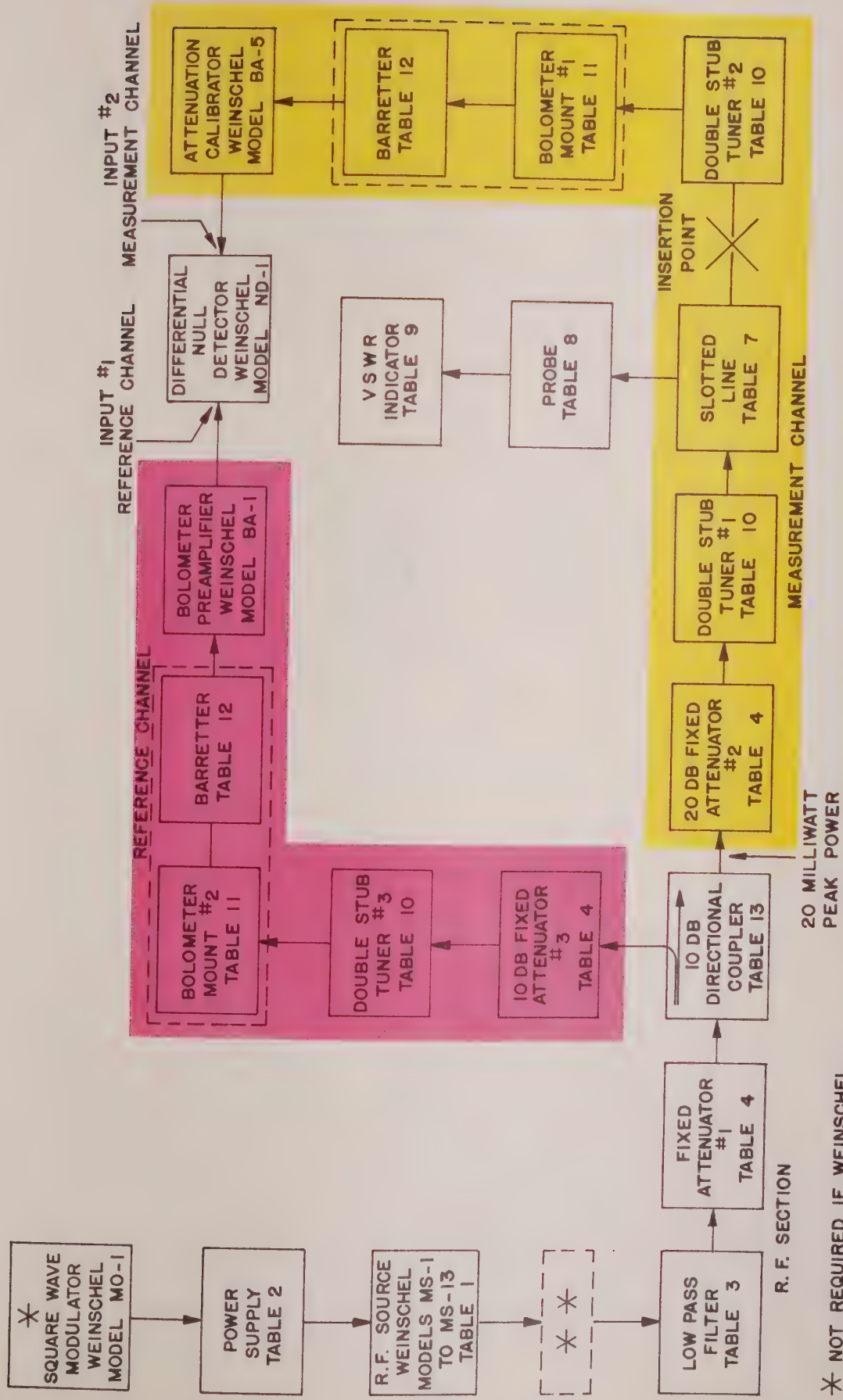
- 9.1 Set up equipment as shown in Figure 4.
- 9.2 Insert and tune RF PROBE at the slotted line for maximum indication on the standing wave indicator. (NOTE: When using the H-P 415B Standing Wave Indicator, the attenuator on the 415B should be at the 40 db or 50 db position, adjust output level of RF source if necessary.)
- 9.3 Adjust tuner #1 for an indicated VSWR of less than 1.01:1 from the generator section.
- 9.4 Set up equipment as shown in Figure 3A and connect output of slotted line to Double Stub Tuner #2.
- 9.5 Repeat Step 9.2.
- 9.6 Adjust tuner #2 for an indicated VSWR of less than 1.01:1 from the measurement bolometer.

#### 10. IMPEDANCE ADJUSTMENT OF THE REFERENCE CHANNEL

- 10.1 Set up equipment as shown in Figure 5.
- 10.2 Insert and tune RF PROBE at the slotted line for maximum indication on the standing wave indicator. (NOTE: When using the H-P 415B Standing Wave Indicator, the attenuator on the 415B should be at the 40 db or 50 db position, adjust output level of RF Source if necessary.)
- 10.3 Adjust tuner #3 for an indicated VSWR of less than 1.01:1 from the reference bolometer.

After completion of the above procedure set up equipment again as shown in Figure 3A, complete connection at insertion point, but remove slotted line.





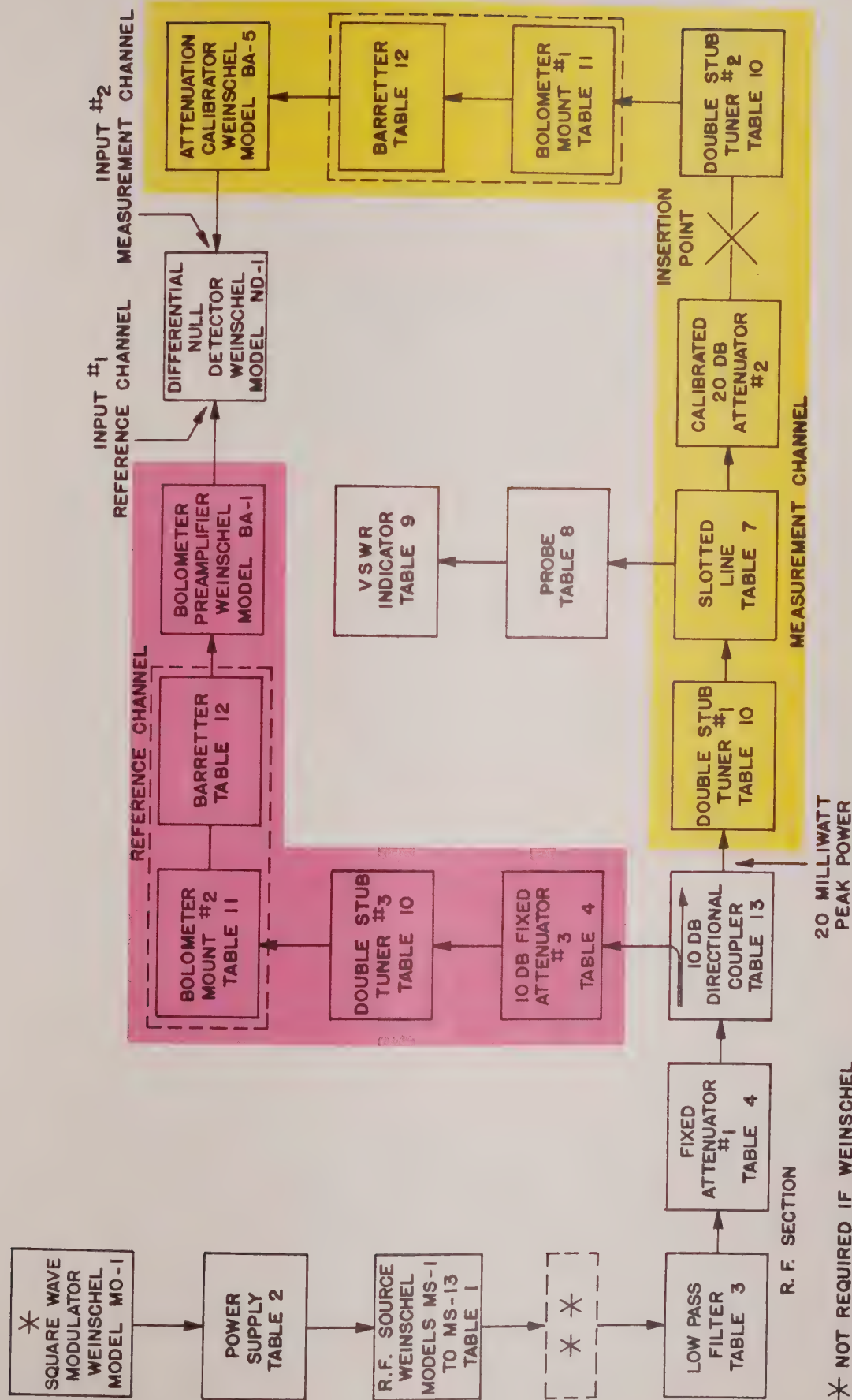
\* NOT REQUIRED IF WEINSCHTEL MODEL MO-3 IS USED WITH MODELS MS-8 TO MS-11.

\*\* INSERT FREQUENCY MONITORING SECTION HERE, IF DESIRED. SEE FIGURE 6

FIGURE 3A, BLOCK DIAGRAM

DUAL CHANNEL INSERTION LOSS TEST SET UP TO 20 DB. COAXIAL SYSTEM



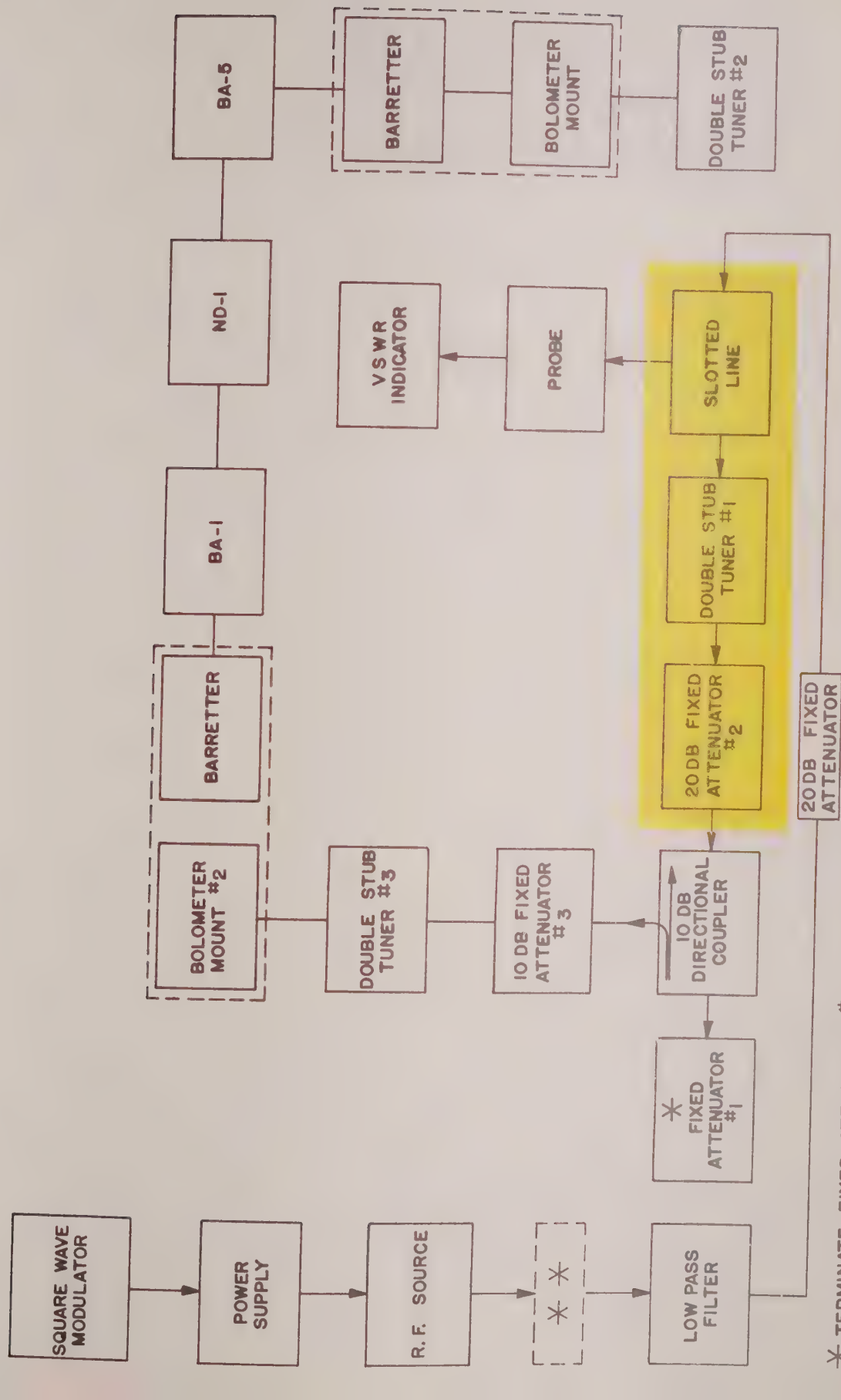


\* NOT REQUIRED IF WEINSCHTEL MODEL MO-3 IS USED WITH MODELS MS-8 TO MS-11

\* INSERT FREQUENCY MONITORING SECTION HERE, IF DESIRED. SEE FIGURE 5

FIGURE 3B, BLOCK DIAGRAM DUAL CHANNEL INSERTION LOSS TEST SET UP FOR





\* TERMINATE FIXED ATTENUATOR #1  
WITH A 50 OHM TERMINATION.

\*\* INSERT FREQUENCY MONITORING  
SECTION HERE, IF DESIRED.  
SEE FIGURE 6.

FIGURE 4, BLOCK DIAGRAM  
SET UP FOR TUNING GENERATOR OUTPUT IMPEDANCE  
AT INSERTION POINT



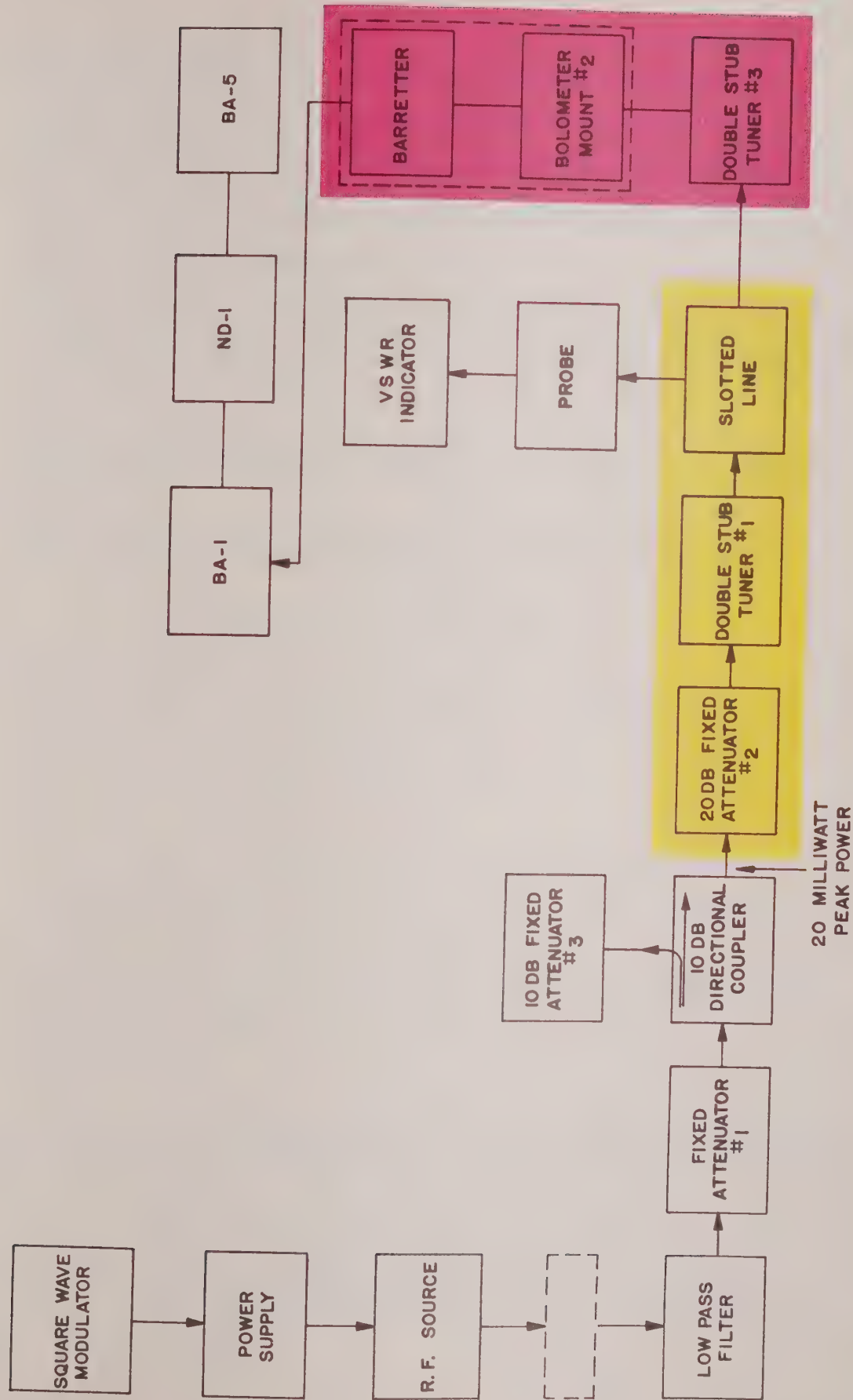


FIGURE 5, BLOCK DIAGRAM  
SET UP FOR TUNING INPUT IMPEDANCE OF REFERENCE BOLOMETER. COAXIAL SYSTEM



11. ADJUSTMENT OF PROPER POWER LEVEL AT THE MEASUREMENT BARRETTTER

- 11.1 With the COARSE and FINE gain controls on the BA-5 counterclockwise and all BA-5 attenuators set to zero, the BA-5 meter should be approximately full scale. If this condition does not exist, then adjust the amount of attenuation at the output of the RF source attenuator #1. Do not change attenuator #2 since this will change the impedance at the insertion point.

12. ADJUSTING THE SYSTEM FOR A NULL

- 12.1 Insert a sufficient amount of audio attenuation at the BA-5 to cover the expected insertion loss measurement. Example: BA-5 to read 12.05 db for a 10 db RF measurement; BA-5 to read 22.05 db for a 20 db RF measurement.
- 12.2 Adjust GAIN of the BA-5 until meter reads approximately 7 db on the scale.
- 12.3 Adjust the GAIN of the BA-1 and the phase controls on the ND-1 until a null is obtained. A slight adjustment of the BA-5 FINE gain control may be necessary.
- 12.4 Disconnect both inputs to the ND-1 and adjust "ZERO" control on front panel until meter reads "ZERO". Reconnect and recheck the null.

The system is now ready for an insertion loss measurement.

13. MEASUREMENT PROCEDURE FOR FIXED ATTENUATOR (UP TO 20 DB)

- 13.1 Record attenuator settings on BA-5.
- 13.2 Disconnect RF line at insertion point (Figure 3A).
- 13.3 Insert unit to be measured.
- 13.4 Reduce attenuation in BA-5 until null is again approached.
- 13.5 With MEDIUM and FINE phase controls on the ND-1 and the 0 to .1 db attenuator on the BA-5, adjust for final null.
- 13.6 Record reading of BA-5 attenuators. The difference between the initial setting of the attenuators and the final setting is the insertion loss of the device under test.

14. EXTENDING THE RANGE

In order to extend the range of measurement partial RF substitution must be used. Set up the system as shown in Figure 3B. Fixed attenuator #2 should be calibrated first according to the procedure outlined in paragraph 13.

NOTE: Adjusting the impedance of the Measurement and Reference channels can be accomplished by following the steps outlined in paragraphs 9 and 10. The only difference is that fixed attenuator #2 is not in the system while tuning the line, as shown in Figure 4.



15.     30 DB OR 40 DB MEASUREMENT (FIXED ATTENUATORS)
- 15.1    Set up equipment again as shown in Figure 3B.
- 15.2    Insert 22.05 db of attenuation at the BA-5. Record reading.
- 15.3    Adjust system for null as outlined in Steps 12.2 and 12.3.
- 15.4    Remove attenuator #2 (Calibrated attenuator).
- 15.5    Insert unit under test.
- 15.6    Reduce attenuation in BA-5 and adjust the phase control on the ND-1 until a null is observed.
- 15.7    Record BA-5 attenuator settings.

The difference between the attenuation readings on BA-5 in Steps 15.2 and 15.7 plus the calibration of attenuator #2 is the insertion loss of the unit under test.



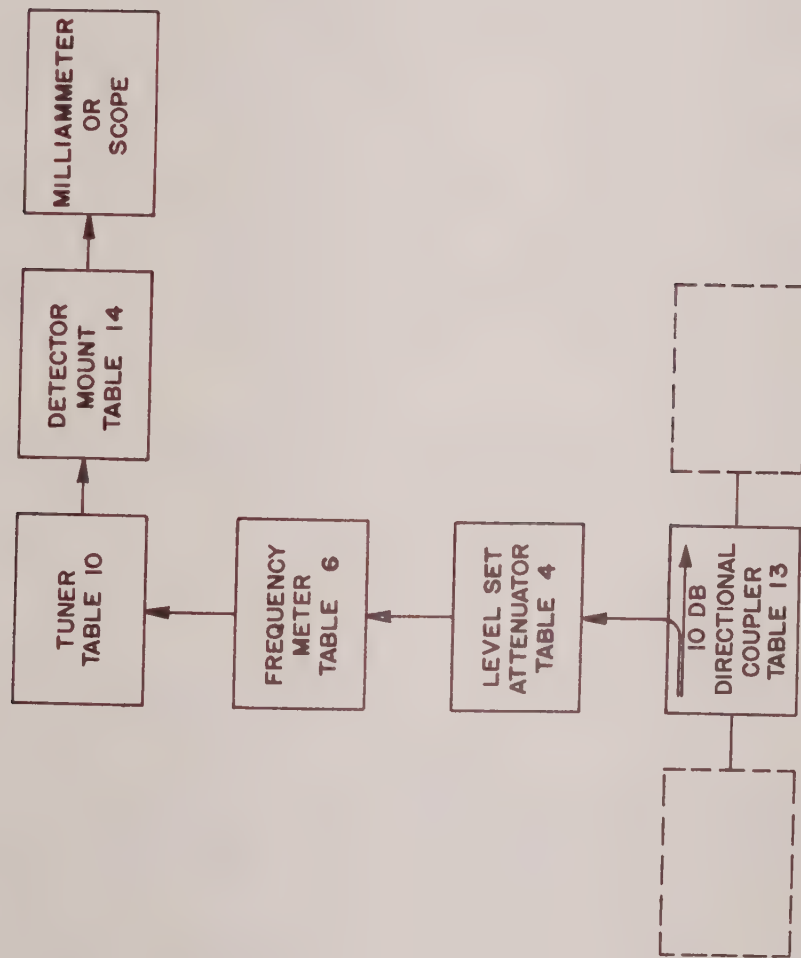


FIGURE 6, BLOCK DIAGRAM  
FREQUENCY MONITORING SECTION.



## SECTION IV

### PRELIMINARY TROUBLESHOOTING GUIDE FOR WEINSCHEL ENGINEERING DUAL CHANNEL SYSTEM

The following troubleshooting procedure can be used to make a fast determination as to what unit is at fault in the system. If all units check out properly then a careful examination of the RF Section should be made to make sure that (1) all connections are tight, (2) the line is properly tuned, and (3) that the system is free from any ground loops between the BA-5 input and the modulator.

1. Make normal hook-up with RF power into both barretters.
2. Set BA-5 attenuators to zero and gain controls to minimum.
3. Raise RF level to obtain full scale deflection on BA-5 meter.
4. Adjust BA-5 attenuators to insert 6 db. This will reduce level on meter to approximately 6.
5. Adjust levels on BA-1 and phase controls on ND-1 for null indication.
6. Disconnect RF from both barretters but leave them connected to the BA-5 and BA-1.
7. Readjust BA-5 attenuators to zero.
8. Disconnect BA-1 output from ND-1. There should be no change of the null on the ND-1.
9. Advance BA-5 coarse gain control to first step. There should be no change of the null.
10. Advance BA-5 coarse gain control to second step. You may get 1/4 of a division on the null indicator.
11. Advance BA-5 coarse gain control to third step. You may get 1/2 to 3/4 of a division movement on the null indicator.

The BA-5 is O.K.

12. Disconnect BA-5 from the ND-1.
13. Connect BA-1 output to appropriate input of ND-1 (Barretter connected to BA-1 but no RF.)
14. With BA-1 set to half of maximum gain, there should be no movement of the null indicator.

The BA-1 and ND-1 are O.K.

15. Disconnect BA-1 from ND-1.
16. Connect output of BA-5 to input No. 2 (Measurement Channel) of ND-1.
17. Apply RF power and repeat IV- 2 and IV-3.
18. Switch in 20 db of the BA-5 attenuator.  
The ND-1 meter should read approximately 120 divisions  $\pm$  20 division.
19. Disconnect output of BA-5 from ND-1 input No. 2 and connect output of BA-5 to ND-1 input No. 1 (Reference Channel). ND-1 meter should read approximately 110 divisions  $\pm$  20 division.

The Dual Channel System is in good condition



Stability of the RF Source can be checked by connecting it to the BA-5 as in a single channel set up (Zero attenuation and gain controls at a minimum). Adjust level of the RF source, without moving the BA-5 controls, to give full scale deflection on the BA-5 meter. Any fluctuations of the BA-5 meter are due to instability in the RF source. Both the RF amplitude and frequency should be stable. The 1000 cps modulator frequency must be stable to better than  $\pm .1$  cps.



## SECTION V

### 100% SQUARE WAVE MODULATION CHECK

If the modulation is to be checked and the system incorporates a frequency monitoring section as outlined in Figure 6 then follow the procedure outlined below. If no frequency monitoring section is used then remove the barretter from the reference bolometer mount and replace it with a crystal. This applies to mounts that use the Narda 610B type barretter. It may be necessary to replace the bolometer mount with a crystal mount. Connect the output of the crystal to a scope with a frequency range of dc to at least 30 kc and follow the procedure outlined below.

#### Procedure:

1. Disconnect RF power at input to the directional coupler and balance scope for zero line reference (Figure 7a).
2. With RF Source operating at CW, reconnect RF line at the directional coupler.
3. Adjust vertical gain control on scope to establish CW reference level (Figure 7a) due to the dc output of the crystal.
4. Apply modulation to RF Source. (1 kc square wave) and the pattern shown in Figure 7b should be observed.





FIGURE 7, OSCILLOSCOPE PATTERNS FOR 100% SQUARE WAVE MODULATION CHECK.



## SECTION VI

### COMPONENT CHARTS FOR DUAL CHANNEL SYSTEM

The following charts are provided for quick and easy selection of the proper RF components necessary for operation of the dual channel system.



TABLE 1  
R.F. SOURCES

| Frequency Range kmcs | Manufacturer** | Model Number | Power Supply Required |
|----------------------|----------------|--------------|-----------------------|
| 0.05 - 0.25          | Weinschel      | MS-1         | None                  |
| 0.05 - 0.25          | Weinschel      | MS-12        | Weinschel Model MO-3* |
| 0.25 - 0.92          | Weinschel      | MS-2         | None                  |
| 0.25 - 0.92          | Weinschel      | MS-13        | Weinschel Model MO-3* |
| 0.90 - 2.00          | Weinschel      | MS-3         | None                  |
| 0.90 - 2.20          | Weinschel      | MS-8         | Weinschel Model MO-3* |
| 1.20 - 3.75          | Raytheon       | 2K-28        | See Table No. 2       |
| 1.99 - 2.10          | Varian         | X-17         | See Table No. 2       |
| 2.00 - 4.20          | Weinschel      | MS-9         | Weinschel Model MO-3* |
| 2.66 - 3.31          | Sperry         | 2K41         | See Table No. 2       |
| 3.3 - 4.20           | Sperry         | 2K42         | See Table No. 2       |
| 4.0 - 7.30           | Weinschel      | MS-10        | Weinschel Model MO-3* |
| 4.2 - 5.70           | Sperry         | 2K43         | See Table No. 2       |
| 5.7 - 7.50           | Sperry         | 2K44         | See Table No. 2       |
| 7.2 - 10.50          | Weinschel      | MS-11        | Weinschel Model MO-3* |
| 7.5 - 10.3           | Sperry         | 2K39         | See Table No. 2       |
| 8.2 - 12.4           | Varian         | X-13         | See Table No. 2       |
| 10.0 - 15.0          | Varian         | V-39-C       | See Table No. 2       |
| 12.4 - 17.5          | Varian         | X-12         | See Table No. 2       |
| 15.0 - 21.0          | Varian         | X-40-C       | See Table No. 2       |
| 22.0 - 25.0          | Raytheon       | 233          | See Table No. 2       |
| 22.0 - 25.0          | Varian         | VA-96        | See Table No. 2       |
| 26.3 - 31.3          | Raytheon       | QK-140       | See Table No. 2       |
| 30.0 - 35.3          | Raytheon       | QK-141       | See Table No. 2       |
| 33.0 - 37.5          | Raytheon       | QK-141       | See Table No. 2       |
| 33.5 - 36.2          | Raytheon       | QK-291       | See Table No. 2       |
| 34.0 - 35.6          | Varian         | VA-97        | See Table No. 2       |
| 34.9 - 40.6          | Raytheon       | QK-142       | See Table No. 2       |
| 37.5 - 44.1          | Raytheon       | QK-226       | See Table No. 2       |
| 41.7 - 50.0          | Raytheon       | QK-294       | See Table No. 2       |
| 50.0 - 60.0          | Raytheon       | QK-295       | See Table No. 2       |

\* Includes Modulator.

\*\* See Code of Manufacturers, Table 15.



TABLE 2  
KLYSTRON POWER SUPPLIED

|                                |                                  |
|--------------------------------|----------------------------------|
| PRD<br>Sperry<br>FXR<br>Varian | 801-A<br>SX-12<br>Z815A<br>V7405 |
|--------------------------------|----------------------------------|

TABLE 3  
LOW PASS FILTERS

| Cutoff<br>Frequency<br>mcms | Manufacturer* | Model Number    |
|-----------------------------|---------------|-----------------|
| .044                        | Sierra        | 184             |
| .076                        | Sierra        | 184             |
| .135                        | Sierra        | 184             |
| .230                        | Sierra        | 184             |
| .400/.5                     | Sierra/Narda  | 184/.3010-500   |
| .400                        | Bird          | 844             |
| .7/1.0                      | H-P/Narda     | 360-A/3010-1000 |
| 1.2                         | Bird          | 819-1200        |
| 1.2                         | H-P           | 360-B           |
| 2.2/2.1                     | H-P/Narda     | 360-C/3010-2100 |
| 4.1/4.2                     | H-P/Narda     | 360-D/3010-4200 |

\*See Code of Manufacturers, Table 15.



TABLE 4  
COAXIAL AND WAVEGUIDE ATTENUATORS

COAXIAL

| Frequency Range kmc | Manufacturer | Model Number |
|---------------------|--------------|--------------|
| D.C. - 1.0          | Weinschel    | 50           |
| D.C. - 1.0          | Weinschel    | 10           |
| 1.0 - 12.4          | Weinschel    | 210          |
| 1.0 - 12.4          | Weinschel    | 503          |

WAVEGUIDE

| Frequency Range kmc | Manufacturer's* Model Number |         |       |     |
|---------------------|------------------------------|---------|-------|-----|
|                     | FXR                          | H-P     | Narda | PRD |
| 2.6 - 3.95          | S-151-A                      | S-375-A | 734   | 171 |
| 3.95 - 5.85         | H-151-A                      | G-375-A | 733   | 162 |
| 5.85 - 8.2          | C-151-A                      | J-375-A | 732   | 161 |
| 7.05 - 10.0         | W-151-A                      | H-375-A | 731   | 160 |
| 8.2 - 12.4          | X-151-A                      | X-375-A | 730   | 159 |
| 12.4 - 18.0         | Y-151-A                      | P-375-A | 729   | 189 |
| 18.0 - 26.5         | K-151-A                      | K-375-A | 728   | 190 |
| 26.5 - 40.0         | U-151-A                      | R-375-A | V-727 | 191 |
| 33.0 - 50.0         | Q-151-A                      |         | Q-727 |     |
| 50.0 - 75.0         | M-151-A                      |         | M-727 | 179 |
| 60.0 - 90.0         | E-151-A                      |         | E-727 |     |

\* See Code of Manufacturers, Table 15.

TABLE 5  
WAVEGUIDE ISOLATORS

| Manufacturer*                                        | Model Number                                               |
|------------------------------------------------------|------------------------------------------------------------|
| Rantec<br>Airtron<br>Kearfott<br>Cascade<br>Raytheon | Consult Manufacturer<br>For Proper Model<br>For Your Needs |

\* See Code of Manufacturers, Table 15.



TABLE 6  
FREQUENCY METERS

| Frequency Range kmcs | Manufacturer* and Model |       |       |      |
|----------------------|-------------------------|-------|-------|------|
|                      | FXR                     | H-P   | Narda | PRD  |
| 0.2 - 0.5            |                         |       | 804   |      |
| 0.250 - 1.0          |                         |       |       | 587A |
| 0.5 - 1.5            |                         |       | 805   |      |
| 1.0 - 4.0            | N410A                   |       |       |      |
| 3.95 - 5.85          | H410A                   |       |       | 532  |
| 5.85 - 8.20          | C410A                   | J530A |       | 533  |
| 8.20 - 12.4          | X410A                   | X532A |       | 535  |
| 12.4 - 18.0          | Y410A                   | P532A |       | 536  |
| 18.0 - 25.5          | K410A                   | K532A |       | 537  |
| 26.5 - 40.0          | U410A                   | R532A |       | 538  |

\* See Code of Manufacturers, Table 15.

TABLE 7  
SLOTTED LINES  
COAXIAL

| Frequency Range kmcs | Manufacturer*     | Model Number                              |
|----------------------|-------------------|-------------------------------------------|
| .02 - .6             | Borg-Warner Corp. | 65                                        |
| .1 - 3.0             | Borg-Warner Corp. | 62                                        |
| .5 - 4.0             | H-P               | 805-A                                     |
| .45 - 4.0            | Narda             | 230-N, 230-C, 230-5/8,<br>230-7/8, 230-SC |
| 1.0 - 4.0            | FXR               | N-101-A †                                 |
| 1.0 - 4.0            | PRD               | 215-A †                                   |
| 1.5 - 12.4           | Narda             | 231-N, 231-C, 231-ENG †                   |
| 3.0 - 12.0           | H-P               | 806-B †                                   |
| 4.0 - 10.0           | FXR               | N-201-B †                                 |
| 4.0 - 10.0           | PRD               | 205-A †                                   |

\* See Code of Manufacturers, Table 15.

† Requires tuning probe -- see table 8.



TABLE 7 (Cont.)

## WAVEGUIDE

| Frequency Range kmcs | Manufacturer's** Model Number |        |            |         |
|----------------------|-------------------------------|--------|------------|---------|
|                      | FXR                           | Narda  | H-P        | PRD     |
| 2.60 - 3.95          | S-101-A †                     | 224 †  | S-810- †   | 209-A † |
| 3.95 - 5.85          | H-101-A †                     | 223 †  | G-810-B/ † | 201-A † |
| 5.85 - 8.2           | C-101-A †                     | 222 †  | J-810-B/ † | 204-B † |
| 7.05 - 10.0          | W-101-A †                     | 221 †  | H-810-B/ † | 202-B † |
| 8.2 - 12.4           | X-101-A †                     | 220 †  | X-810-B/ † | 203-D † |
| 12.4 - 18.0          | Y-102-A                       | 219 †  | P-810B/ †  | 210-A   |
| 18.0 - 26.5          | K-102-A                       | 218*   | P-815-A †  | 211-A   |
| 26.5 - 40.0          | U-102-A                       | V-217* | K-815-A †  | 212-A   |
| 33.0 - 50.0          | Q-103-A                       | Q-217* | R-815-A †  |         |
| 50.0 - 75.0          | M-103-A                       | M-217* |            | 216     |
| 60.0 - 90.0          | E-103-A                       | E-217* |            |         |

\* Requires Detector Mount.

\*\* See Code of Manufacturers, Table 15.

/ Used with Universal Probe Carriage.

† Requires tuning probe -- see table 8.

TABLE 8

## PROBES

| Frequency Range kmc | Manufacturer* | Model Number  |
|---------------------|---------------|---------------|
| 1.0 - 12.4          | FXR           | B-200-A       |
| 1.0 - 12.4          | PRD           | 250-A tunable |
| .9 - 18.0           | Narda         | 229 tunable   |
| 8.0 - 18.0          | H-P           | 444-A untuned |
| 12.4 - 40.0         | H-P           | 446-A untuned |

\* See Code of Manufacturers, Table 15.

TABLE 9

## VSWR INDICATORS

| Manufacturer* | Model Number |
|---------------|--------------|
| H-P           | 415-B        |
| PRD           | 277          |
| FXR           | B-810-A      |
| Narda         | 441          |

\* See Code of Manufacturers, Table 15.

TABLE 10

## TUNERS

## COAXIAL TUNERS

| Frequency Range kmcs | Manufacturer | Model Number |
|----------------------|--------------|--------------|
| .20 - 2.0            | Weinschel    | DS-109LL     |
| .40 - 4.0            | Weinschel    | DS-109L      |
| .75 - 10.0           | Weinschel    | DS-109       |

## WAVEGUIDE TUNERS

| Frequency Range kmcs | Manufacturer's* Model Number |       |       |                    |
|----------------------|------------------------------|-------|-------|--------------------|
|                      | H-P                          | PRD   | Narda | FXR                |
| 2.60 - 3.95          | S-870-A                      | 309-A | 964   | S-311-A<br>S-312-A |
| 3.95 - 5.85          | G-870-A                      | 300-A | 963   | H-311-A<br>H-312-A |
| 5.85 - 8.20          | J-870-A                      | 305-A | 962   | C-311-A<br>C-312-A |
| 7.05 - 10.0          | H-870-A                      | 302-B | 961   | W-311-A<br>W-312-A |
| 8.2 - 12.4           | X-870-A<br>X-880-A           | 303-A | 960   | X-311-A<br>X-312-A |
| 12.4 - 18.0          | P-870-A<br>P-880-A           | 314-A | 959   | Y-311-A<br>Y-312-A |
| 18.0 - 26.5          | K-870-A<br>K-880-A           | 313-A | 958   | K-312-B            |
| 26.5 - 40.0          | R-870-A<br>R-880-A           | 312-A | V-957 | U-312-B            |
| 33.0 - 50.0          |                              |       | Q-957 | Q-312-B            |
| 50.0 - 75.0          |                              | 323   | M-957 | M-312-B            |
| 60.0 - 90.0          |                              |       | E-957 | E-312-B            |

\* See Code of Manufacturers, Table 15.

522

1. *Chlorophyll a* (Chl *a*)  
 2. *Chlorophyll b* (Chl *b*)  
 3. *Chlorophyll c* (Chl *c*)  
 4. *Chlorophyll d* (Chl *d*)  
 5. *Chlorophyll e* (Chl *e*)  
 6. *Chlorophyll f* (Chl *f*)  
 7. *Chlorophyll g* (Chl *g*)  
 8. *Chlorophyll h* (Chl *h*)  
 9. *Chlorophyll i* (Chl *i*)  
 10. *Chlorophyll j* (Chl *j*)  
 11. *Chlorophyll k* (Chl *k*)  
 12. *Chlorophyll l* (Chl *l*)  
 13. *Chlorophyll m* (Chl *m*)  
 14. *Chlorophyll n* (Chl *n*)  
 15. *Chlorophyll o* (Chl *o*)  
 16. *Chlorophyll p* (Chl *p*)  
 17. *Chlorophyll q* (Chl *q*)  
 18. *Chlorophyll r* (Chl *r*)  
 19. *Chlorophyll s* (Chl *s*)  
 20. *Chlorophyll t* (Chl *t*)  
 21. *Chlorophyll u* (Chl *u*)  
 22. *Chlorophyll v* (Chl *v*)  
 23. *Chlorophyll w* (Chl *w*)  
 24. *Chlorophyll x* (Chl *x*)  
 25. *Chlorophyll y* (Chl *y*)  
 26. *Chlorophyll z* (Chl *z*)  
 27. *Chlorophyll aa* (Chl *aa*)  
 28. *Chlorophyll ab* (Chl *ab*)  
 29. *Chlorophyll ac* (Chl *ac*)  
 30. *Chlorophyll ad* (Chl *ad*)  
 31. *Chlorophyll ae* (Chl *ae*)  
 32. *Chlorophyll af* (Chl *af*)  
 33. *Chlorophyll ag* (Chl *ag*)  
 34. *Chlorophyll ah* (Chl *ah*)  
 35. *Chlorophyll ai* (Chl *ai*)  
 36. *Chlorophyll aj* (Chl *aj*)  
 37. *Chlorophyll ak* (Chl *ak*)  
 38. *Chlorophyll al* (Chl *al*)  
 39. *Chlorophyll am* (Chl *am*)  
 40. *Chlorophyll an* (Chl *an*)  
 41. *Chlorophyll ao* (Chl *ao*)  
 42. *Chlorophyll ap* (Chl *ap*)  
 43. *Chlorophyll aq* (Chl *aq*)  
 44. *Chlorophyll ar* (Chl *ar*)  
 45. *Chlorophyll as* (Chl *as*)  
 46. *Chlorophyll at* (Chl *at*)  
 47. *Chlorophyll au* (Chl *au*)  
 48. *Chlorophyll av* (Chl *av*)  
 49. *Chlorophyll aw* (Chl *aw*)  
 50. *Chlorophyll ax* (Chl *ax*)  
 51. *Chlorophyll ay* (Chl *ay*)  
 52. *Chlorophyll az* (Chl *az*)  
 53. *Chlorophyll aza* (Chl *aza*)  
 54. *Chlorophyll abz* (Chl *abz*)  
 55. *Chlorophyll acz* (Chl *acz*)  
 56. *Chlorophyll adz* (Chl *adz*)  
 57. *Chlorophyll aez* (Chl *aez*)  
 58. *Chlorophyll afz* (Chl *afz*)  
 59. *Chlorophyll agz* (Chl *agz*)  
 60. *Chlorophyll ahz* (Chl *ahz*)  
 61. *Chlorophyll aiz* (Chl *aiz*)  
 62. *Chlorophyll ajz* (Chl *ajz*)  
 63. *Chlorophyll akz* (Chl *akz*)  
 64. *Chlorophyll alz* (Chl *alz*)  
 65. *Chlorophyll amz* (Chl *amz*)  
 66. *Chlorophyll anz* (Chl *anz*)  
 67. *Chlorophyll aoz* (Chl *aoz*)  
 68. *Chlorophyll apz* (Chl *apz*)  
 69. *Chlorophyll aqz* (Chl *aqz*)  
 70. *Chlorophyll arz* (Chl *arz*)  
 71. *Chlorophyll asz* (Chl *asz*)  
 72. *Chlorophyll atz* (Chl *atz*)  
 73. *Chlorophyll auz* (Chl *auz*)  
 74. *Chlorophyll avz* (Chl *avz*)  
 75. *Chlorophyll awz* (Chl *awz*)  
 76. *Chlorophyll axz* (Chl *axz*)  
 77. *Chlorophyll ayz* (Chl *ayz*)  
 78. *Chlorophyll azz* (Chl *azz*)  
 79. *Chlorophyll azaa* (Chl *aza*)  
 80. *Chlorophyll abz* (Chl *abz*)  
 81. *Chlorophyll acz* (Chl *acz*)  
 82. *Chlorophyll adz* (Chl *adz*)  
 83. *Chlorophyll aez* (Chl *aez*)  
 84. *Chlorophyll afz* (Chl *afz*)  
 85. *Chlorophyll agz* (Chl *agz*)  
 86. *Chlorophyll ahz* (Chl *ahz*)  
 87. *Chlorophyll aiz* (Chl *aiz*)  
 88. *Chlorophyll ajz* (Chl *ajz*)  
 89. *Chlorophyll akz* (Chl *akz*)  
 90. *Chlorophyll alz* (Chl *alz*)  
 91. *Chlorophyll amz* (Chl *amz*)  
 92. *Chlorophyll anz* (Chl *anz*)  
 93. *Chlorophyll aoz* (Chl *aoz*)  
 94. *Chlorophyll apz* (Chl *apz*)  
 95. *Chlorophyll aqz* (Chl *aqz*)  
 96. *Chlorophyll arz* (Chl *arz*)  
 97. *Chlorophyll asz* (Chl *asz*)  
 98. *Chlorophyll atz* (Chl *atz*)  
 99. *Chlorophyll auz* (Chl *auz*)  
 100. *Chlorophyll avz* (Chl *avz*)  
 101. *Chlorophyll awz* (Chl *awz*)  
 102. *Chlorophyll axz* (Chl *axz*)  
 103. *Chlorophyll ayz* (Chl *ayz*)  
 104. *Chlorophyll azz* (Chl *azz*)  
 105. *Chlorophyll azaa* (Chl *aza*)  
 106. *Chlorophyll abz* (Chl *abz*)  
 107. *Chlorophyll acz* (Chl *acz*)  
 108. *Chlorophyll adz* (Chl *adz*)  
 109. *Chlorophyll aez* (Chl *aez*)  
 110. *Chlorophyll afz* (Chl *afz*)  
 111. *Chlorophyll agz* (Chl *agz*)  
 112. *Chlorophyll ahz* (Chl *ahz*)  
 113. *Chlorophyll aiz* (Chl *aiz*)  
 114. *Chlorophyll ajz* (Chl *ajz*)  
 115. *Chlorophyll akz* (Chl *akz*)  
 116. *Chlorophyll alz* (Chl *alz*)  
 117. *Chlorophyll amz* (Chl *amz*)  
 118. *Chlorophyll anz* (Chl *anz*)  
 119. *Chlorophyll aoz* (Chl *aoz*)  
 120. *Chlorophyll apz* (Chl *apz*)  
 121. *Chlorophyll aqz* (Chl *aqz*)  
 122. *Chlorophyll arz* (Chl *arz*)  
 123. *Chlorophyll asz* (Chl *asz*)  
 124. *Chlorophyll atz* (Chl *atz*)  
 125. *Chlorophyll auz* (Chl *auz*)  
 126. *Chlorophyll avz* (Chl *avz*)  
 127. *Chlorophyll awz* (Chl *awz*)  
 128. *Chlorophyll axz* (Chl *axz*)  
 129. *Chlorophyll ayz* (Chl *ayz*)  
 130. *Chlorophyll azz* (Chl *azz*)  
 131. *Chlorophyll azaa* (Chl *aza*)  
 132. *Chlorophyll abz* (Chl *abz*)  
 133.

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1. 2000-2001 2001-2002 2002-2003 2003-2004 2004-2005 2005-2006 2006-2007 2007-2008 2008-2009 2009-2010 2010-2011 2011-2012 2012-2013 2013-2014 2014-2015 2015-2016 2016-2017 2017-2018 2018-2019 2019-2020 2020-2021 2021-2022 2022-2023 2023-2024 2024-2025 2025-2026 2026-2027 2027-2028 2028-2029 2029-2030 2030-2031 2031-2032 2032-2033 2033-2034 2034-2035 2035-2036 2036-2037 2037-2038 2038-2039 2039-2040 2040-2041 2041-2042 2042-2043 2043-2044 2044-2045 2045-2046 2046-2047 2047-2048 2048-2049 2049-2050 2050-2051 2051-2052 2052-2053 2053-2054 2054-2055 2055-2056 2056-2057 2057-2058 2058-2059 2059-2060 2060-2061 2061-2062 2062-2063 2063-2064 2064-2065 2065-2066 2066-2067 2067-2068 2068-2069 2069-2070 2070-2071 2071-2072 2072-2073 2073-2074 2074-2075 2075-2076 2076-2077 2077-2078 2078-2079 2079-2080 2080-2081 2081-2082 2082-2083 2083-2084 2084-2085 2085-2086 2086-2087 2087-2088 2088-2089 2089-2090 2090-2091 2091-2092 2092-2093 2093-2094 2094-2095 2095-2096 2096-2097 2097-2098 2098-2099 2099-2100 2100-2101 2101-2102 2102-2103 2103-2104 2104-2105 2105-2106 2106-2107 2107-2108 2108-2109 2109-2110 2110-2111 2111-2112 2112-2113 2113-2114 2114-2115 2115-2116 2116-2117 2117-2118 2118-2119 2119-2120 2120-2121 2121-2122 2122-2123 2123-2124 2124-2125 2125-2126 2126-2127 2127-2128 2128-2129 2129-2130 2130-2131 2131-2132 2132-2133 2133-2134 2134-2135 2135-2136 2136-2137 2137-2138 2138-2139 2139-2140 2140-2141 2141-2142 2142-2143 2143-2144 2144-2145 2145-2146 2146-2147 2147-2148 2148-2149 2149-2150 2150-2151 2151-2152 2152-2153 2153-2154 2154-2155 2155-2156 2156-2157 2157-2158 2158-2159 2159-2160 2160-2161 2161-2162 2162-2163 2163-2164 2164-2165 2165-2166 2166-2167 2167-2168 2168-2169 2169-2170 2170-2171 2171-2172 2172-2173 2173-2174 2174-2175 2175-2176 2176-2177 2177-2178 2178-2179 2179-2180 2180-2181 2181-2182 2182-2183 2183-2184 2184-2185 2185-2186 2186-2187 2187-2188 2188-2189 2189-2190 2190-2191 2191-2192 2192-2193 2193-2194 2194-2195 2195-2196 2196-2197 2197-2198 2198-2199 2199-2200 2200-2201 2201-2202 2202-2203 2203-2204 2204-2205 2205-2206 2206-2207 2207-2208 2208-2209 2209-2210 2210-2211 2211-2212 2212-2213 2213-2214 2214-2215 2215-2216 2216-2217 2217-2218 2218-2219 2219-2220 2220-2221 2221-2222 2222-2223 2223-2224 2224-2225 2225-2226 2226-2227 2227-2228 2228-2229 2229-2230 2230-2231 2231-2232 2232-2233 2233-2234 2234-2235 2235-2236 2236-2237 2237-2238 2238-2239 2239-2240 2240-2241 2241-2242 2242-2243 2243-2244 2244-2245 2245-2246 2246-2247 2247-2248 2248-2249 2249-2250 2250-2251 2251-2252 2252-2253 2253-2254 2254-2255 2255-2256 2256-2257 2257-2258 2258-2259 2259-2260 2260-2261 2261-2262 2262-2263 2263-2264 2264-2265 2265-2266 2266-2267 2267-2268 2268-2269 2269-2270 2270-2271 2271-2272 2272-2273 2273-2274 2274-2275 2275-2276 2276-2277 2277-2278 2278-2279 2279-2280 2280-2281 2281-2282 2282-2283 2283-2284 2284-2285 2285-2286 2286-2287 2287-2288 2288-2289 2289-2290 2290-2291 2291-2292 2292-2293 2293-2294 2294-2295 2295-2296 2296-2297 2297-2298 2298-2299 2299-2300 2300-2301 2301-2302 2302-2303 2303-2304 2304-2305 2305-2306 2306-2307 2307-2308 2308-2309 2309-2310 2310-2311 2311-2312 2312-2313 2313-2314 2314-2315 2315-2316 2316-2317 2317-2318 2318-2319 2319-2320 2320-2321 2321-2322 2322-2323 2323-2324 2324-2325 2325-2326 2326-2327 2327-2328 2328-2329 2329-2330 2330-2331 2331-2332 2332-2333 2333-2334 2334-2335 2335-2336 2336-2337 2337-2338 2338-2339 2339-2340 2340-2341 2341-2342 2342-2343 2343-2344 2344-2345 2345-2346 2346-2347 2347-2348 2348-2349 2349-2350 2350-2351 2351-2352 2352-2353 2353-2354 2354-2355 2355-2356 2356-2357 2357-2358 2358-2359 2359-2360 2360-2361 2361-2362 2362-2363 2363-2364 2364-2365 2365-2366 2366-2367 2367-2368 2368-2369 2369-2370 2370-2371 2371-2372 2372-2373 2373-2374 2374-2375 2375-2376 2376-2377 2377-2378 2378-2379 2379-2380 2380-2381 2381-2382 2382-2383 2383-2384 2384-2385 2385-2386 2386-2387 2387-2388 2388-2389 2389-2390 2390-2391 2391-2392 2392-2393 2393-2394 2394-2395 2395-2396 2396-2397 2397-2398 2398-2399 2399-2400 2400-2401 2401-2402 2402-2403 2403-2404 2404-2405 2405-2406 2406-2407 2407-2408 2408-2409 2

100-7-11

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TABLE 11

## BOLOMETER MOUNTS

## COAXIAL BOLOMETER MOUNTS

| Frequency<br>Range<br>kmc | Input<br>Connector | Trans<br>mission<br>Line | Use<br>Barretter<br>Type No. | Manufacturer's* Model Number |      |       |                       |          |
|---------------------------|--------------------|--------------------------|------------------------------|------------------------------|------|-------|-----------------------|----------|
|                           |                    |                          |                              | FXR                          | H-P  | Narda | PRD                   | Notes    |
| 0.02 - 1.0                | UG-23/U            | 3/8"                     | +                            |                              | 476A |       |                       |          |
| 0.02 - 1.5                | UG-23/U            | 3/8"                     | 2 of 3                       |                              |      | 560   |                       |          |
| 0.10 - 10.0               | UG-21/U            | 3/8"                     | 1,2                          | N-210A                       |      |       |                       | a        |
| 0.10 - 10.0               | UG-21/U            | 3/8"                     | 1,2                          | N-210B                       |      |       |                       | b,c<br>b |
| 0.50 - 10.0               | UG-23/U            | 3/8"                     | 8                            |                              |      | 561   | 627-A                 | a        |
| 0.50 - 10.0               | UG-23/U            | 3/8"                     | 9                            |                              |      |       |                       | a        |
| 1.0 - 10.0                | UG-21/U            | 3/8"                     | 1,2                          |                              |      |       | 612-A<br>613<br>613-M | d        |
| 1.0 - 10.0                | UG-21/U            | 3/8"                     | 1,2                          |                              |      |       |                       | b,c      |
| 1.0 - 10.0                | UG-21/U            | 3/8"                     | 1,2                          |                              |      |       |                       | b        |

\* See Code of Manufacturers, Table 15.

+ 1/100 Amp. instrument fuse, four (4) required (10 MA Little Fuse). These selected by H-P for use in the H-P 476A mount.

a-Broadband

b-Requires external tuning

c-Requires external DC return

d-Self-contained tuning



TABLE 11 (Cont.)

## WAVEGUIDE BOLOMETER MOUNTS

| Frequency<br>Range<br>kmc | Input<br>Connector | Trans-<br>mission<br>Line | Use<br>Barretter<br>Type No. | Manufacturer's* Model Number |         |       |         |
|---------------------------|--------------------|---------------------------|------------------------------|------------------------------|---------|-------|---------|
|                           |                    |                           |                              | FXR                          | H-P     | Narda | PRD     |
| 2.6 - 3.95                | UG-53/U            | RG-48/U                   | 4                            |                              | S-485-A | 514   |         |
| 2.6 - 3.95                | UG-53/U            | RG-48/U                   | 12                           |                              |         | 534†  |         |
| 3.95 - 5.85               | UG-149/U           | RG-49/U                   | 2,4                          |                              | G-485-B | 513   |         |
| 3.95 - 5.85               | UG-149/U           | RG-49/U                   | 12                           |                              |         | 533†  |         |
| 5.85 - 8.20               | UG-344/U           | RG-50/U                   | 2,4                          |                              | J-485-B | 512   |         |
| 5.85 - 8.20               | UR-344/U           | RG-50/U                   | 12                           |                              |         | 532†  |         |
| 7.05 - 10.0               | UG-51/U            | RG-51/U                   | 2,4                          |                              | H-485-B | 511   |         |
| 7.05 - 10.0               | UG-51/U            | RG-51/U                   | 12                           |                              |         | 531†  |         |
| 8.2 - 12.4                | UG-39/U            | RG-52/U                   | 2,4                          |                              | H-485-B | 511   |         |
| 8.2 - 12.4                | UG-39/U            | RG-52/U                   | 2                            | X-211-A                      |         |       |         |
| 8.2 - 12.4                | UG-39/U            | RG-52/U                   | 12                           |                              |         | 530†  |         |
| 12.4 - 18.0               | UG-419/U           | RG-91/U                   | 2,4,5                        |                              |         | 509   |         |
| 12.4 - 18.0               | UG-419/U           | RG-91/U                   | 11                           |                              |         | 529†  |         |
| 12.4 - 18.0               | UG-419/U           | RG-91/U                   | 5                            | Y-205-B                      |         |       | 620     |
| 18.0 - 26.5               | UG-425/U           | RG-66/U                   | 10                           |                              |         |       |         |
| 18.0 - 26.5               | UG-595/U           | RG-66/U                   | 10                           |                              |         |       | 620-F-1 |
| 18.0 - 26.5               | UG-425/U           | RG-53/U                   | 5                            | K-205-B                      |         |       |         |
| 18.0 - 26.5               | UG-595/U           | RG-53/U                   | 5                            | K-205-F                      |         |       |         |
| 26.5 - 40.0               | UG-599/U           | RG-96/U                   | 6                            | U-205-F                      |         |       |         |
| 26.5 - 40.0               | UG-599/U           | RG-96/U                   | 7                            | U-206-F                      |         |       |         |
| 26.5 - 40.0               | UG-599/U           | RG-96/U                   | 10                           |                              |         |       | 618-F-1 |
| 26.5 - 40.0               | UG-381/U           | RG-96/U                   | 10                           |                              |         |       |         |
| 33.0 - 50.0               | UG-383/U           | RG-97/U                   | 7                            | Q-206-B                      |         |       |         |
| 50.0 - 75.0               | UG-383/U           | RG-98/U                   | 7                            | M-206-B                      |         |       |         |
| 60.0 - 90.0               | UG-387/U           | RG-99/U                   | 7                            | E-206-B                      |         |       |         |

\* See Code of Manufacturers, Table 15.

† Fixed Tuned



TABLE 12  
200 OHM BARRETTERS

| Type | Fits Mount For            | Shielded | Unshielded | DC Bias MA | Manufacturer's** Model Number |             |       |        | Special Features                       | For     |           |
|------|---------------------------|----------|------------|------------|-------------------------------|-------------|-------|--------|----------------------------------------|---------|-----------|
|      |                           |          |            |            | FXR                           | Narda       | PRD   | Sperry |                                        | Coaxial | Waveguide |
| 1    | 1N21                      | X        |            | 4.5        | Z-220-C                       | N-610-B-4.5 | 610-A |        |                                        | X       |           |
| 2    | 1N21                      |          | X          | 4.5        |                               |             |       |        |                                        | X       | X         |
| 2    | 1N21                      |          | X          | 4.5        |                               |             |       |        |                                        | X       | X         |
| 2    | 1N21                      |          | X          | 8.75       | Z-220-A                       |             |       |        |                                        | X       | X         |
| 2    | 1N21                      |          | X          | 8.25       | Z-220-B                       |             |       |        |                                        | X       | X         |
| 2    | 1N21                      |          | X          | 8.75       |                               | N-610-B     |       |        |                                        | X       | X         |
| 3    | 1N21                      |          | X          | 8.75       |                               | N-610-B-100 |       |        | Use 2                                  | X       | X         |
| 4    | 0.93" dia.<br>0.812" long |          | X          | 8.75       |                               | N-821-B     |       | 821    |                                        | X       | X         |
| 5    | 1N26                      | X        |            | 4.5        |                               |             | 614   |        | 12.4-<br>26.5 kmc                      |         | X         |
| 5    | 1N26                      | X        |            | 8.75       | Z-221-A                       |             |       |        | 12.4-<br>40 kmc                        |         | X         |
| 6    | Modified<br>1N26          | X        |            | 8.75       | Z-221-B                       |             |       |        | 26.5-<br>40 kmc                        |         | X         |
| 7    | 1N53                      | X        |            | 8.75       | Z-222-A                       |             |       |        | 26.5-<br>90 kmc                        |         | X         |
| 8    | Special<br>Mica Strip     |          | X          | 4.5        |                               | N-603-4.5   | 631-C |        | 0.5-<br>10 kmc                         | X       |           |
| 9    | " "                       |          | X          | 8.75       |                               | N-603       |       |        | 0.5-<br>10 kmc                         | X       |           |
| 10   | " "                       |          | X          | 4.5        |                               |             | 617   |        | 18-40<br>kmc                           | X       | X         |
| 11   | Miniature                 |          | X          | 8.75       |                               | N-604       |       |        | 8.2-18<br>kmc                          |         | X         |
| 12   | 1N21                      |          | X          | 8.75       |                               | N-605       |       |        | (Low In-<br>ductance)<br>1.1-10<br>kmc |         | X         |

\* See Coaxial Bolometer Mounts, Table 11.

\*\* See Code of Manufacturers, Table 15.

The barretters with lower bias current require about 2 db less rf for the same 1000 cps output. They may burn out if 4 milliwatts rf power are added while those with higher bias current may burn out if 16 milliwatts rf power are added.



TABLE 13  
DIRECTIONAL COUPLERS  
COAXIAL

| Frequency Range kmc | Manufacturer* | Model   |
|---------------------|---------------|---------|
| .225 - .460         | Narda         | 3000-10 |
| .460 - .950         | Narda         | 3001-10 |
| .950 - 2.0          | Narda         | 3002-10 |
| 2.0 - 4.0           | Narda         | 3003-10 |

\* See Code of Manufacturers, Table 15.

WAVEGUIDE

| Frequency Range kmc | Manufacturer's Model No. |       |     |          |
|---------------------|--------------------------|-------|-----|----------|
|                     | H-P                      | FXR   | PRD | Narda    |
| 2.6 - 3.95          | S752C                    | S610C | 409 | 1074-10  |
| 3.95 - 5.85         | G752C                    | H610C | 410 | 1073-10  |
| 5.85 - 8.2          | J752C                    | C610C | 411 | 1072-10  |
| 7.05 - 10.0         | H752C                    | W610C | 412 | 1071-10  |
| 8.2 - 12.4          | X752C                    | X610C | 408 | 1070-10  |
| 12.4 - 18.0         | P752C                    | Y610C | 413 | 1069-10  |
| 18.0 - 26.5         | K752C                    | K610C |     | 1068-10  |
| 26.4 - 40.0         | R752C                    | U610C |     | V1067-10 |
| 50.0 - 75.0         |                          | M610C |     | M1067-10 |

\* See Code of Manufacturers, Table 15.



TABLE 14  
DETECTOR MOUNTS  
COAXIAL TYPES

| Frequency Range kmcs | Manufacturer* and Model Number     | Crystal Type           |
|----------------------|------------------------------------|------------------------|
| 0.01 - 1.0           | PRD, Model 641                     | Sylvania 1N21          |
| 0.5 - 1.0            | Am. Elect. Lab. Model C1000        | Microwave Assoc. MA408 |
| 1.0 - 10.0           | Weinschel Engineering<br>Model 578 | Microwave Assoc. MA408 |

\* See Code of Manufacturers, Table 15.

WAVEGUIDE TYPES

| Frequency Range kmcs | Manufacturer*, Model Number and Crystal Type |                |      |                |                  |                |       |                |
|----------------------|----------------------------------------------|----------------|------|----------------|------------------|----------------|-------|----------------|
|                      | Aircom                                       | Crystal Type** | PRD  | Crystal Type** | Microwave Assoc. | Crystal Type** | FXR   | Crystal Type** |
| 3.95 - 5.85          | 157-C                                        | 1N23           |      |                |                  |                |       |                |
| 5.85 - 8.2           | 157-XC                                       | 1N23           |      |                |                  |                |       |                |
| 8.2 - 12.4           | 157-X                                        | 1N23           |      |                | 536C             | 1N23           | X211A | 1N23           |
| 12.4 - 18.0          | 157-KU                                       | 1N78           | 616A | 1N78           |                  |                | Y205B | 1N26           |
| 18.0 - 26.5          | 157-K                                        | 1N26           | 621  | 1N26           | 1039C            | 1N26           | K205B | 1N26           |
| 26.5 - 40.0          | 157-KA                                       | 1N53           |      |                | 513E             | 1N53           | U206B | 1N53           |
| 33.0 - 50.0          | 157-V                                        | 1N53           |      |                |                  |                | Q206B | 1N53           |
| 50.0 - 75.0          | 157-W                                        | 1N53           |      |                | 669              | 1N53           | M206B | 1N53           |

\*See Code of Manufacturers, Table 15

\*\*Sylvania Model Number Listed.



TABLE 15  
CODE OF MANUFACTURERS\*

| Abbreviation      | Manufacturer's Name and Address                                                             |
|-------------------|---------------------------------------------------------------------------------------------|
| Aircom            | Aircom, Inc.<br>48 Cummington Street<br>Boston, Mass.                                       |
| Airtron           | Airtron, Inc.<br>200 East Hanover Avenue<br>Morris Plains, New Jersey                       |
| Am. Elect. Lab.   | American Electronics Labs., Inc.<br>121 N. 7th Street<br>Philadelphia 6, Pa.                |
| Bird              | Bird Electronics Corp.<br>1800 East 38th Street<br>Cleveland, Ohio                          |
| Borg-Warner Corp. | Borg-Warner, Corp.<br>3300 Newport Blvd.<br>Santa Anna, California                          |
| Cascade           | Cascade Research<br>5245 San Fernando Road, W.<br>Los Angeles, California                   |
| FXR               | FXR, Inc.<br>25-26 50th Street<br>Woodside 77, New York                                     |
| H-P               | Hewlett-Packard Co.<br>1501 Page Mill Road<br>Palo Alto, California                         |
| Kearfott          | Kearfott Division<br>General Precision, Inc.<br>14844 Oxnard Street<br>Van Nuys, California |
| Micro Assoc.      | Microwave Associates, Inc.<br>Burlington, Mass.                                             |
| Narda             | Narda Microwave Corp.<br>118-160 Herricks Road<br>Mineola, New York                         |
| PRD               | PRD Electronics, Inc.<br>202 Tillary Street<br>Brooklyn 1, New York                         |



TABLE 15 (Cont.)

| Abbreviation | Manufacturer's Name and Address                                             |
|--------------|-----------------------------------------------------------------------------|
| Rantec       | Rantec Corp.<br>Craftsman Center<br>Calabasas, California                   |
| Raytheon     | Raytheon Co.<br>Microwave and Power Tube Division<br>Waltham 54, Mass.      |
| Sierra       | Sierra Electronic Corp.<br>3885 E. Bohannon Drive<br>Menlo Park, California |
| Sperry       | Sperry Microwave Electronics Co.<br>P.O. Box 1828<br>Clearwater, Florida    |
| Varian       | Varian Associates<br>611 Hansen Way<br>Palo Alto, California                |

\* This List does not constitute an Endorsement.





MP MASTER



MA35909